

OBITUARY NOTICES OF FELLOWS DECEASED.

ROBERT GRANT was born at Grantown, in Strathspey, on June 17, 1814, and received his early education at a school established by the Earl of Seafield, which provided, for the children of the district, instruction in those branches of education which are required to enter the Scottish Universities. But at the age of 13 his studies were interrupted by a serious illness; and it was not until the completion of his 19th year that his health was sufficiently restored to enable him to continue his studies with success. After a course of private study, Grant entered King's College, Aberdeen, but before the completion of the University course he removed to London and became engaged in business pursuits under his brother. At this time, Grant commenced to collect materials for a history of physical astronomy, and in 1845, in order to obtain access to further sources of information, he removed to Paris, where he supported himself by teaching English. In Paris, Grant had the great advantages of attending the astronomical lectures of Arago and Le Verrier, and the use of the books in the library of the Institute, of which he availed himself in the collection of the materials for his history.

Grant returned to London in 1847, and devoted himself to the preparation of his *History of Physical Astronomy*. This work was first published in parts in 'The Library of Useful Knowledge:' the first part appeared in September, 1848, and, although the author was previously unknown to most of the leading English astronomers, it immediately attracted attention, and led to Mr. Grant being elected a Fellow of the Royal Astronomical Society. The history was published in a separate form in March, 1852; and in the following November Grant was elected a member of the Council of the Royal Astronomical Society, and was appointed editor of 'The Monthly Notices;' and in 1856 the Gold Medal of the Society was awarded to him for his work. Grant's *History of Physical Astronomy* had certainly no rival in the English language at the time of its publication; it can still be consulted with great advantage upon any of the points with which it treats, and its impartiality is unquestionable.

In November, 1859, Grant was appointed Regius Professor of Astronomy and Director of the Observatory in the University of

Glasgow, and after a short course of practical instruction at Greenwich, he took charge of the Observatory at Glasgow, and continued to hold that post until the time of his death in 1892.

The Observatory was provided with an Ertel Transit Circle of six French inches aperture, and the chief astronomical work of the Observatory during Professor Grant's tenure of office was done with this instrument. The staff at the Glasgow Observatory was not a large one, and the salaries attached to the assistantships were so small that Grant had great difficulty in retaining for any length of time the services of skilled assistants, but he was able, by great perseverance and personal devotion to the work, to complete a catalogue of 6415 stars, reduced to the epoch 1870, and a catalogue of 2156 stars for the epoch 1890. The last proof sheet of the second catalogue was only passed by him on the morning of his death. Many of the stars in these two catalogues have not been recently observed at any other observatory, and the places are, therefore, comparatively of greater value than would otherwise be the case, and the results have already been found valuable for very closely approximate determinations of the proper motions of many stars not before known, and for the reduction of comet observations.

The results, however, can hardly be regarded as strictly independent determinations. For reasons which appeared sufficient to Grant it was thought expedient to compare the places of the stars observed at Glasgow with existing recent observations at Greenwich of the same stars, and to deduce corrections for the Glasgow places observed since 1865 to render them in mean results identical with the Greenwich results. The corrections thus found were then applied to the places of the Glasgow catalogue, which should, therefore, not differ systematically from those which would have been obtained had these stars been observed at Greenwich. There are, of course, advantages in such a method of proceeding when the observations have been made with an instrument of a class not suitable for independent work, but much is lost by the want of independence of the results if the instrument is a reliable one. It is, however, impossible for anyone not well acquainted with the Glasgow instrument to judge of the necessity for the course pursued by Grant in this case.

Besides the observations made with the Transit Circle, many extra-meridional observations were made with the 9-inch equatorial by Cooke, the public clocks of Glasgow were controlled from the Observatory, and regular photographic meteorological observations maintained.

Professor Grant took part in the Solar Eclipse expedition to Spain in 1860. He was elected a Fellow of the Royal Society in 1865.

Professor Grant married September 3, 1874, Elizabeth Emma, daughter of A. C. Davison, of Newcastle, New South Wales, by

whom he leaves one son and three daughters. He died at Grantown on October 24, 1892, in the 79th year of his age.

With Admiral Smyth and Professor Baden-Powell, he published a translation of Arago's 'Popular Astronomy,' two vols., 1855—1858, and a volume of 'Biographical Notices of Scientific Men.' He greatly contributed to the exposure of the Pascal forgeries (see 'Comptes Rendus,' 1867), by calling attention to the data extracted from Newton's published works and used by him, which were quoted in the forged letters, but which were not in existence in Pascal's lifetime; he also communicated seventeen papers to the Royal Astronomical Society.

E. J. S.

ARTHUR MILNES MARSHALL was born at Birmingham on June 8, 1852, and died on December 31, 1893. He was the second son of William P. Marshall, for many years Secretary of the Institution of Civil Engineers. He entered St. John's College, Cambridge, in 1871, and read for the Natural Sciences Tripos. In those days the Biological Sciences did not hold the prominent position in the University curriculum which they do at the present time, but the influence which has since brought about such a marked development of these studies at Cambridge had already begun its work, and Marshall was one of the first to take advantage of the new state of things.

As an undergraduate his studies met with every success: he was elected Scholar of his College in June, 1873, and in 1874 he was placed at the head of the first class of the Natural Sciences Tripos. After taking his degree in January, 1875, he went to Naples, having been appointed by the University to their table at the recently-established Zoological Station. He returned in the summer of 1875, and in the October Term joined with Balfour in giving a course of lectures, accompanied by practical work, on Zoology. He was elected Fellow of St. John's College in 1877.

In the same year he gave up—temporarily as it fortunately turned out—the prosecution of his purely scientific studies, and went to St. Bartholomew's Hospital to work at medicine. His medical studies continued until 1879, when he was appointed to the newly-established chair of Zoology in the Owens College.

He was now able to devote himself wholly to the pursuit of science. He took up again the embryological work which he had begun at Naples, and which had necessarily somewhat languished during his medical studies, and published a series of memoirs in the 'Quarterly Journal of Microscopical Science' on the morphology of the vertebrate head. These were entitled: "The Development of the Cranial Nerves in the Chick," 1878; "The Morphology of the Vertebrate Olfactory Organ," 1879; "Observations on the Cranial

Nerves of Scyllium," 1881 (in conjunction with his pupil W. B. Spencer); "On the Head Cavities and Associated Nerves of Elasmobranchs," 1881; to which must be added "The Segmental Value of the Cranial Nerves," published in 1882 in the 'Journal of Anatomy and Physiology.' These memoirs all influenced in an important manner the views and work of the cranial morphologists of the time.

But the principal part of his work at Manchester was connected with the development of the zoological teaching, and of the Museum; and as Secretary, and later, Chairman of the General Board of Studies, with the organisation of the courses of study of Victoria University. These duties left him but little time for research, but in spite of this drawback we have in the latter years of his life the following works from his pen:—

"On the Nervous System of *Antedon rosaceus*," 1884.

"Report on the Pennatulida, dredged by H.M.S. 'Triton,' and H.M.S. 'Porcupine,'" published in the 'Transactions of the Royal Society of Edinburgh,' vols. 32 and 33.

"On the Development of the Kidneys and Fat Bodies in the Frog," and "On the Development of the Blood Vessels in the Frog," both in 1890, and in conjunction with his pupil, E. J. Bles.

Although his multifarious duties at Owens left him but little time for research, he was fully alive to its importance; and he encouraged it in his pupils, and gave them every opportunity of prosecuting work of the kind, as witnesses of which statement are the two volumes of Studies from the Biological Laboratory of the Owens College, published in 1886 and 1890.

As a teacher, he was excellent—clear and accurate. A good measure of his capacities in this direction may be obtained by an examination of the three text-books which he wrote: "The Frog," the "Practical Zoology," and the "Vertebrate Embryology." Accuracy, clearness, and thoroughness in their various grades are the most characteristic features of these books.

He was a man of great energy and determination of character, of a kindly and cheerful disposition which made him very popular with his friends and colleagues; and of an enthusiastic nature, which contributed largely to his success as a teacher.

His death, which took place when he was climbing Scawfell with some friends, was due to an accident. Apparently the stone on which he was standing slipped from him, and he fell on to the rocks below.

His loss will be felt not only at Owens, but all over the North of England, where he was well known by his persistent advocacy of the extension movement, to further which he gave much of his own valuable time.

He was elected a Fellow of the Royal Society in 1885, and served

on the Council in the Year 1891-92. He was President of Section D, at the Leeds meeting of the British Association (1890), and was for many years President of the Manchester Microscopical Society. He was D.Sc. of London University (1877) and M.D. of Cambridge (1882).

A. S.

CHARLES ROMLEY ALDER WRIGHT, who became a Fellow of the Royal Society in 1881, was born at Southend, in Essex, in 1844. His father, Romley Wright, a civil engineer, was at one time employed on the Ordnance Survey of this country, and in the course of his work made some observations on the geology of the county of Salop, which were published in the 'Transactions of the Geological Society' for 1837. During the son's boyhood his parents removed to Manchester, and in due time Charles Wright was entered at Owens College to be educated for the profession of his father. At that period—the early years of the 60's—the college was housed in Quay Street, in the dingy, old-fashioned, red-brick building which had served Richard Cobden as a residence. In the rear of the building there had been erected a well-equipped chemical laboratory—indeed, as things went at that time, it was held to be a very paragon among such places—and here young Wright, under the stimulating guidance of Roscoe and Schorlemmer, found ample opportunity to develop the liking for experimental chemistry which had manifested itself during his home life. Quick-witted, bright and intelligent, with a capacity for boyish fun, and a fertility of resource in the exercise of it, which excited the admiration and at times, it must be added, the amazement of his less-gifted fellows, Wright appeared to overtake his college work with an ease and celerity that seemed to them little short of marvellous. Thanks, however, to his father's training, he had been early schooled into the habit of doing with all his might whatsoever his hand found to do, and this capacity for work never left him. His career at Owens was exceptionally brilliant; prize after prize, not only in chemistry, but also in physics, which he studied under Clifton, in mathematics, which he had from Sandeman, and in classics, which he learnt from Greenwood, fell, session after session, to his share. His course in connexion with his graduation work at the University of London was hardly less distinguished. On matriculating, in 1863, he gained the highest place and prize in chemistry; and at the intermediate examination in the following year he was awarded the Exhibitions both in chemistry and natural philosophy, and was made an Associate of Owens College.

Wright's first essay in experimental investigation was done under Roscoe's direction. It consisted of an enquiry into the relative sensitiveness of photographic paper salted with different haloids and

mixtures of haloids, and was published in the 'Journal of the Chemical Society' for 1866. All his tastes predisposed him towards an academic position, but circumstances compelled him to seek for employment in technology, and shortly after his first paper appeared he accepted a situation as chemist at the Weston Works of the Runcorn Soap and Alkali Company. Here, with characteristic ardour, he at once began a number of investigations relating to the manufacture of sulphuric acid and alkali, the main results of which appeared in the 'Journal of the Chemical Society' and in the 'Chemical News.' He soon, however, turned his face towards London, and became an assistant to the late Dr. Bernays, in the laboratory attached to St. Thomas's Hospital. Afterwards he joined Matthiessen, and the two chemists began the remarkable series of investigations on the opium alkaloids with which their names, as joint authors, are associated, and one outcome of which was the discovery of apomorphine, one of the most powerful and valuable emetics known. In 1869 he was associated with Sir Lowthian Bell in an elaborate investigation on the theory of iron smelting, the results of which are contained in Sir Lowthian Bell's well-known work 'On the Principles of the Manufacture of Iron and Steel.'

In 1871 Wright became Lecturer on Chemistry at St. Mary's Hospital, and he occupied this position at the time of his death. He once more turned his attention to the chemistry of the alkaloids, and began the study of the essential oils, and during the next ten years memoir followed memoir in quick succession. Either alone or in conjunction with his pupils he contributed nine papers on Derivatives of Morphine and Codeine to the Royal Society (1871-74); six papers on Isomeric Terpenes to the 'British Association Reports' (1873-77); six papers on the Action of Organic Acids and their Anhydrides on Natural Alkaloids (1874-80); seven papers on Narceine, Narcotine, Cotarnine, and Hydrocotarnine to the Chemical Society (1874-77); four papers on the Alkaloids of the Aconites (1877-79); and three on the Alkaloids of the Veratrums (1878-79) to the 'British Association Reports,' in addition to occasional papers on other departments of vegetal chemistry. During the latter portion of this period he also contributed a series of Reports on Chemical Dynamics to the Chemical Society (1878-80). Questions relating to chemical physics had always great interest for him; and he sent to the Physical Society, of which he was one of the original members, a series of nine papers on the Determination of Chemical Affinity in terms of Electromotive Force, and, in conjunction with Professor Roberts-Austen, he made a number of measurements of the Specific Heat of Hydrogenium (1873). For some years back he occupied himself with the study of alloys, and the Proceedings of the Royal Society contain a number of papers

by him on this subject. Indeed, his last paper, written a few days before his death, on the invitation of the London Section of the Society of Chemical Industry, consists of a *résumé* of the conclusions to which his long-continued work on this subject had led him. He maintained his touch with technology until the last, and he was an acknowledged authority on those branches of manufacturing chemistry with which he had become practically acquainted during his career. Gifted with a remarkable literary faculty and power of exposition, Wright was much sought after as a contributor to the literature of chemical technology. He wrote a number of articles on tar distilling and tar products in 'Muspratt's Dictionary;' the articles on iron and steel in the last edition of the 'Encyclopædia Britannica,' and the monographs on "Soap," "Sulphur," and "Sulphuric Acid" in Thorpe's 'Dictionary of Applied Chemistry.' In 1878 he gave a series of lectures at the Royal Institution on "Metals and their Industrial Applications," which were subsequently expanded and published in book form; and, in 1885, he gave a course of Cantor lectures at the Society of Arts on the "Manufacture of Soap." He was a frequent contributor to the proceedings of the London Section of the Society of Chemical Industry, and the Journal of the Society contains a number of his communications.

Wright took an active share in the formation of the Association which ultimately developed into the Institute of Chemistry, and he was a member of the Council of that body.

Much of his work was done under the depressing conditions of indifferent health, and at times he experienced great physical pain. From his boyhood he had suffered from an affection of the hip joint, which eventually ended in lameness, and the consequent inability to take exercise reacted very markedly upon his general health. His friends, however, were hardly prepared for the suddenness of his end. After an illness of a few hours' duration, he died on the 25th July, 1894, having barely attained his forty-ninth year.

T. E. T.

GEORGE JOHN ROMANES was born at Kingston, Canada West, on May 20, 1848; but, his parents having soon after removed to England, his childhood was spent in London or its immediate neighbourhood. Ill-health having rendered it desirable that he should reside in a warmer climate, the family subsequently left England, and, in consequence, his education was somewhat irregular. The surroundings of his boyhood and youth were, however, both enjoyable and healthful, and conduced to the development of that love of out-of-door life and intense interest in the external aspects of nature, which were so prominent in his after life. Romanes entered at Caius College, Cambridge, in 1869, and subsequently obtained a scholarship

in that college. He graduated through the Natural Science Tripos in 1870. After taking his degree he entered on the study of medicine, and threw himself into the work of the hospital and dissecting room with great ardour; but in 1872 he was completely disabled by a severe and protracted illness, which led to his abandoning his intention of entering the profession of medicine. The writer became acquainted with him in the autumn of 1874. He had occupied himself during the previous year in biological studies, and was above all an ardent disciple of Mr. Darwin, with whom he had already corresponded, and soon after came into personal relation. For a couple of years Romanes was a worker in the Physiological Laboratory at University College, London, and dated therefrom (1876) his first contribution to the Royal Society. In the autumn of the same year he began his physiological experiments on *Medusæ* and sea urchins, and erected for the purpose a convenient marine laboratory close to his house at Dunskaith, at the entrance of Cromarty Firth, where he spent many happy autumns, engaged partly in pursuit of game, partly in serious work. He first became known to the general public in 1878, when he was invited to deliver one of the evening lectures at the British Association at Dublin on "Animal Intelligence," the substance of which took the form of a book in 1881. This was followed by a volume on 'Mental Evolution in Animals,' and, later, by 'Mental Evolution in Man.' He was admitted to the Fellowship of the Royal Society in 1879. In 1885 he undertook to deliver an academical course in Edinburgh, which comprised some thirty lectures, and extended over three years. He was subsequently (1888) appointed Fullerian Professor at the Royal Institution, and brought together the substance of his London and Edinburgh lectures in a treatise entitled 'Darwin and after Darwin.' His other works will be referred to in the following paragraphs.

Romanes died suddenly of cerebral hæmorrhage on May 23, 1894. Threatening symptoms of arterial disease had appeared in the summer of 1892, which were followed by a formidable illness in July, 1893. After this he travelled to the south of France, returning to Oxford, where he had resided since 1890, in the spring in much improved health. Up to the end he preserved not only his mental vigour, but the keenness of his interest in his scientific pursuits.

It is proposed in the following paragraphs first, to give an account of Romanes' physiological work, then of his contributions to what is now understood by the term biology, and, finally, to refer very briefly to his psychological writings.

The subject of his first communication to the Royal Society (May, 1876) was "The Influence of Injury on the Excitability of Motor Nerves." Of this paper, it is sufficient to say that the observations

were made with great care, and that the new facts recorded have been fully confirmed by later observers.

The first of the very extended series of researches relating to the "locomotor system" of the Medusæ, starfishes, and sea urchins was published in the 'Philosophical Transactions' the same year, 1876, the last in 1881. These are so well known in consequence of their having been placed before the public in one of the volumes of the International Scientific Series, that it is sufficient to notice one or two points of interest relating to them. As regards the Medusæ, the chief value of Romanes' numerous and varied experiments consisted in the light they threw on elementary questions in physiology relating to excitability and conduction. As regards the arrangement and distribution of the nervous system, it is interesting to note how closely his inferences from experiment coincided with the anatomical facts brought to light a year or two later by the researches of the brothers Hertwig. In the researches on the Echinodermata, which were undertaken five years later, Romanes was aided in the anatomical part of his inquiry by his friend Professor Ewart. Throughout, his mode of working was the same, and was characteristic of the worker. His method was not to elaborate a plan of research beforehand, ascertaining what questions had been left uninvestigated by previous observers, but rather to find out all he could, before he began to experiment, about the phenomena which presented themselves to his observation in the out-of-door study of animal life. Residing, as has been said, at the entrance of Cromarty Firth, the animals that he chose as the subjects of inquiry were those which most abounded in its waters. In the study of starfishes and sea urchins, he began by observing their mode of progression, the way in which the animals recover themselves when placed in unnatural positions, the way in which they encounter or escape from an attacking enemy, and then proceeded by the ordinary methods of physiological experiment to the investigation of the functions of the nervous system, and to the determination of the way in which the movements of the animal are co-ordinated. Throughout, the value of his results was enhanced by the circumstance that he availed himself freely of the opportunity which his position afforded him of multiplying his experiments, and confirming every observation by repeating it on individuals belonging to a variety of species.

Between 1882 and 1893 Romanes offered no further contribution of any moment to the Royal Society; but in the latter year (see 'Proceedings,' vol. 54, p. 333) he submitted summaries of two experimental inquiries, one of which, on Plant Excitability, was so closely related to his early physiological studies that it may be most conveniently noticed here. Its purpose was to prove that the bending of plants towards any source of light is so little dependent on the *quan-*

tity and so entirely on the *suddenness* of the illumination, that a series of instantaneous exposures at intervals of two seconds produces in a given time a greater effect than continuous illumination from the same source for the whole period—a proof that in this case the action in question is “liberated,” not “maintained,” by light. The remarkable capacity for experimental investigation which was exhibited in these and in his earlier physiological studies made it a matter of regret to many of his friends that he did not continue them.

An account must now be given of his work in the field of general biology. His interest in Darwinian questions dates from the time which preceded and followed his becoming acquainted with Mr. Darwin in 1874. This acquaintance soon ripened into a friendship, to the reality of which the writer can testify. It was promoted first by the fact that in those early student days, Romanes' mind was, so to speak, steeped in Darwinian doctrine; but it owed its permanence to his possessing certain rare and brilliant intellectual qualities which Mr. Darwin highly appreciated.

As he himself tells us (see ‘*Nature*,’ vol. 8, p. 432, 1873), it was in discussing with Mr. Darwin some of the cases in which the effects of disuse appear to be inherited, that his attention was directed to a principle—now held by many biologists to be of great importance—that of the action of “panmixia” or “negative selection” (Weismann), or as Romanes at that time called it, “cessation of selection.” His claim to priority in this matter was, however, weakened by the circumstance that he did not set forth this principle as of universal application—as the *only* way by which, consistently with the recognition of the “all sufficiency of natural selection” (Weismann, ‘*Cont. Review*,’ p. 334), the disappearance of superfluous organs can be accounted for. Another subject of interest to him was also of directly Darwinian origin. It seems to have been suggested by a well-known passage in which Mr. Darwin pointed out that specific characters which “do not affect the welfare of the species” cannot be attributed to natural selection (‘*Origin*,’ 6th ed., p. 176). Romanes' ideas on this point did not take form until, in 1886, he communicated to the Linnean Society his well-known article on “Physiological Selection; an additional Suggestion on the Origin of Species.” The title was perhaps an unfortunate one, for it suggested a purpose which was very far from being that of the writer. It seemed like an attack on the fundamental doctrine of the ‘*Origin*.’ Notwithstanding its rather speculative character, the essay on “Physiological Selection” must be considered as the most important of his biological writings, for it sets before the reader, in terms which cannot be mistaken, that if by species is meant an association of animals or plants which is distinguished by the incapacity of its members to unite sexually with outsiders, the coming into existence of this disability as a barrier

between them is a factor in the origin of species of which sufficient account has not been taken.

Romanes' precise position in relation to this contentious subject may be stated very shortly. Other naturalists had shown that isolation of part of a species, whether by geographical or other external obstacles to sexual intercourse, inevitably led to the acquirement by the plants or animals thus separated, of characters different from those of the remainder, and eventually to the setting up of the bar of reciprocal sterility between them. To this, without professing to explain it, Romanes added the statement that the setting up of this "physiological" barrier *may be the primary event, i.e.,* that it may come into existence between one part of a species and the rest in the absence of any structural difference, or other external obstacle to sexual union, and thus, having no cause itself, become the prime cause of all other differences. He himself admitted that his "theory" was but a statement of what he believed actually to happen, leaving the explanation of it, with that of variation in general, to the "future of physiology" ('Linn. Soc. Zool. Proc.,' vol. 19, p. 337). During the following half-dozen years he spent much time and labour in bringing together confirmatory instances, the results of which will no doubt soon be published. The chief claim to consideration of this theory consists in the prominence which it gives to what Romanes calls "mutual sterility, with fertility *inter se*," as that which constitutes the essence of species; in other words, to the subordination of all other specific distinctions to the one primary and dominant one—*sterility to outsiders*. Had he contented himself with showing that whenever a variety is promoted to the rank of a species, that promotion consists in the setting up of the "bar of sterility"—that the protection of this barrier, however set up, is essential to the progressive modification by natural selection of the species—and that there are reasons for believing that the functional disability may come into existence in the absence of recognisable structural difference, no one would have fallen into the mistake of supposing that it was his intention to substitute a new doctrine for the Darwinian.

As regards the question whether acquired characters are inherited, it is sufficient to say that both the direct and the indirect evidence seemed to Romanes to tend towards the affirmative. His physiological training probably made him more alive than he would otherwise have been to the difficulties which present themselves in all those cases in which the apparatus required for the performance of a complicated function must be in complete working order before it can be of the slightest use to the organism, and consequently must have arrived at perfection of development independently of the operation of natural selection. The particular case in which he emphasises this difficulty is that of the complicated automatic and perfectly

co-ordinated bodily movements of the higher animals, the performance of which involves the co-operation of a complicated system of sense organs, sensory nerves, centres, motor nerves, and muscles; it being obvious that the power of so co-ordinating the actions of these various parts as to ensure the accomplishment of the required purpose is as certainly transmitted to offspring by inheritance as any morphological character. All that Romanes has written on this subject—voluminous as it is—is in complete accord with Mr. Herbert Spencer's contention, that the "coadaptation of parts cannot be accounted for by the natural selection of variations arising fortuitously." This doctrine he did his best to corroborate by new examples, considering Mr. Spencer's line of argument exceedingly "cogent against all ultra-Darwinians."

In dealing with the much more difficult question of the direct evidence for or against the inheritance of acquired characters, Romanes found the same difficulties as other naturalists. It is well known that for many years he sought, with praiseworthy perseverance, to verify the experimental results obtained by the late Dr. Brown-Séquard as regards the transmission to offspring of certain structural defects and pathological tendencies, originally produced in guinea-pigs by injuries of the central nervous system. Although some of the experiments made for this purpose yielded interesting results, the appearances observed were not sufficiently constant or decisive to enable him to confirm Brown-Séquard's conclusions. In addition to these experiments of his own, he was unceasing in his efforts to bring together all the experimental evidence that he could get hold of, either by reading or correspondence, relating to the conditions under which structural modifications produced by environment persist in the offspring of plants and animals for many generations, independently of the external conditions which originally produced them. On the question of so-called Telegony, he endeavoured to obtain information, partly by correspondence, partly by experiments (see 'Contemporary Review,' 1893, p. 512). To what extent these efforts were productive, the writer is unable to say, but there seems reason to hope that the collected evidence, when published in the forthcoming second volume of 'Darwin, and after Darwin,' will be of considerable interest. It may be noted that, although Romanes agrees with Mr. Spencer in regarding telegony, if true, to be fatal to the doctrine of "Germplasm," his idea of its mechanism is different.

During the year which preceded his death, Romanes published the work entitled 'An Examination of Weismannism.' Its purpose, as stated in the Preface, was not to discuss either the question of the inheritance of acquired characters, with which Professor Weismann's name is so closely associated, or the conception of the architecture of germplasm, which is no less essential to his general theory. What

he had in view was rather to trace, for the information of non-biological readers, the successive stages through which that theory has passed during the half-dozen years that it has been before the reading public in England. Notwithstanding its polemical character, it contains much that is of value and interest, particularly the comparison between the theory of heredity, submitted to the Royal Society by Mr. Francis Galton in 1872, with the doctrine now advocated by the great German naturalist.

In conclusion, reference must be made to Romanes' numerous and valuable contributions to the study of comparative psychology. On this subject Professor Lloyd Morgan has been kind enough to furnish the writer with some valuable notes.

Romanes first became known as a writer on comparative psychology when he delivered, as already mentioned, one of the evening lectures on "Animal Intelligence," at the meeting of the British Association at Dublin in 1878. His first published work with the same title appeared in 1881. In it he set forth conclusions as to the mental endowments of animals, which were founded partly on his own observations, partly on those of other persons, which he had collected from a great variety of sources. This preparatory volume was followed in 1883 by a work on 'Mental Evolution in Animals,' in which he lucidly and brilliantly set forth what he regarded as the principles of the subject. Into this treatise were "woven" as *quotations* certain notes given to Romanes by Mr. Darwin during his life; besides which "a part of Mr. Darwin's chapter on Instinct, written for the 'Origin of Species,' but afterwards suppressed for the sake of condensation," was added as an appendix.

'Mental Evolution in Animals' was followed in 1888 by an instalment of a work on 'Mental Evolution in Man,' dealing with the origin of the human faculty. It was the last work of the Mental Evolution Series which the author was ever to complete; but it was his intention to widen the field of discussion at a later period. The book encountered its full share of criticism. The author's views were objected to, on the one hand, by those to whom the evolution of human from animal intelligence was unacceptable, on the other, by those who, on scientific grounds, were unable to accept Romanes' interpretation of animal faculty. All, however, would be willing to admit that, to quote the words of Professor Lloyd Morgan, "by his patient collection of data, by his careful discussion of these data in the light of principles clearly and definitely formulated, by his wide and forcible advocacy of his views, and above all by his own observations and experiments, Mr. Romanes left a mark in this field of investigation and interpretation which is not likely to be effaced."

In the preceding paragraphs an endeavour has been made to give a concise summary of Romanes' contributions to biological science.

Such an account would not, however, completely enable the reader to form a just conception of the influence which he exercised during the last ten years of his life, by his writings and public utterances. It would, indeed, be doing scant justice to his memory if, even in recording the dry additions to knowledge which resulted from his work, we were to forget what science owes to him for having awakened in the minds of thousands of readers, both in England and in America, that interest in the relations of man to his living surroundings, which is so often the first step in the training of a naturalist. All who know Romanes' writings will agree that, quite independently of the subjects to which they relate, they possess qualities which sufficiently account for the favour with which they have been received on both sides of the Atlantic. Even those who are at variance with Romanes on fundamental questions, are charmed by the unconstrained and natural way in which his originality shines out in his language, and reconciled, in spite of their convictions, by the directness and simplicity of his reasoning. A considerable share of the interest which the questions on which he wrote at present excite, may be directly traced to his writings, the popularity of which affords the best evidence of their adaptedness to their purpose.

One word as to Romanes' personal qualities. He had many opponents, no enemies. Transparently honest himself and scarcely knowing what bitterness meant, he looked for and found the same kindness and honesty in others and thus often made friends of his antagonists. The wide range of his interests and the number of the subjects about which he was able to talk suggestively, made him a most attractive companion. He was courteous to all, but reserved the best of his gifts—his overflowing charity and ungrudging sympathy—for his intimate friends. To how many who stood in this relation to him is his loss an irreparable calamity!

J. B. S.

ALPHONSE DE CANDOLLE: When the history of the progress of botany during the 19th century shall be written, no names will be more conspicuous for the value and extent of their united labours than those of the de Candolle's, father and son, Auguste Pyrame and Alphonse. Their labours embraced every department of the science, morphological, physiological, systematic, geographical, and economic, and were uninterrupted during ninety-five years, those of the father extending from 1798 to 1842, and of the son from 1824 to 1893. And if the period during which their labours overlapped be taken into account, the total amounts to 113 years.

The subject of this notice, Alphonse Louis Pierre de Candolle, was born in Paris, October 27, 1806, and passed his earlier years at Montpellier, where his father, a Genevese, of Huguenot descent, and a

Protestant, held the professorship of botany. In 1814 the father was transferred to the botanical chair of Geneva, and there, in 1825, Alphonse took the degree of Bachelor of Science, and commenced the study of law. In 1829 he took his doctor's degree in that faculty, selecting as the subject of his inaugural thesis "*Le Droit de Grâce.*" It should be observed, in passing, that his legal education had a marked influence on his subsequent career, both as a citizen and as a botanist; on the one hand it qualified him to undertake civic duties of inestimable advantage to his canton and country, and on the other it contributed largely to the development of those qualities of exactitude in collecting and recording facts, of methodical arrangement of these, and of cautious reasoning, that are predominant features in all his scientific writings.

From a very early age Alphonse de Candolle had developed a love of botany, and, when only 18 years old, he published his first contribution to this science, in a paper on *Agaricus tubæformis*,* a remarkable dimorphic fungus, found on the wood of thermal baths in Piedmont, which appeared in the '*Annales des Sciences Naturelles*' (vol. 1, p. 347).

In 1830 he began to co-operate with his father in the elaboration of the colossal '*Prodromus Systematis Vegetabilium*,' by the preparation of a monograph in advance of that work, on the *Campanulaceæ*, which at once raised him to a high position as a botanist. It was followed in 1832 by another monograph, supplemental to the '*Prodromus*,' upon the very obscure and little known tropical family of *Anonaceæ*, which, owing to the want of materials, had been inefficiently dealt with in that work. On his father's death in 1841 the future conduct of the '*Prodromus*' was undertaken by Alphonse, who for upwards of half a century zealously laboured towards its completion as editor and part author of the eight succeeding volumes; and thereafter of its continuation in the '*Monographiæ Phanerogamarum*,' in which he was zealously aided by his eminent son Casimir.

Alphonse de Candolle's individual contributions to the '*Prodromus*' consist of detailed descriptions of forty-five natural families, containing 438 genera and upwards of 5300 species. Amongst these the most important are the *Myrsinaceæ*, *Lobeliaceæ*, *Apocynaceæ*, *Myristicaceæ*, *Begoniaceæ*, and *Cupuliferæ*. The judgment of botanists upon these (and upon those not enumerated) is that they exhibit all the best qualities of monographic work, scientific and scholarly. As an example of the completeness of his work, the last mentioned order (*Cupuliferæ*) may be instanced. It includes the great genus of oaks, which had previously been represented descriptively by a chaos of ill-

* Some of the most eminent botanists commenced the study of plants with the lower cryptogams, as did the elder de Candolle, the first of whose long list of publications was on the nutrition of lichens.

defined species of the north temperate zone, and little more than indications of the existence of a vast contingent of Oriental, Asiatic, and Malayan groups of species, specimens of which were scattered through various great herbaria of Europe. These last presented the greatest difficulties, and as showing how successfully they were treated, it is instructive to find that in Dr. King's very recent magnificent illustrated work on the oaks of India and the Malay Islands, and which is founded on materials immeasurably superior to what Alphonse de Candolle had access to, and on double the number of species, all but one-eighth of those described in the *Prodromus* are found to have been satisfactorily established upon sound scientific principles.

Before concluding the subject of the *Prodromus*, it must be recorded that over and above the labour expended on his own contributions to it was that involved in the editorship of the 17 volumes, in the collection of materials for his collaborators, in the correspondence with the latter, and in the revision of their work in MS. and in the press—laborious and often irksome duties—all scrupulously performed.

The knowledge and experience acquired during the progress of the *Prodromus* led to an exposition, for the guidance of monographers, of his views as to the right method of proceeding in describing plants. Three treatises may be classed under this head. The first is a paper published in 1862, and entitled “*Études sur l'espèce, à l'occasion d'une Révision de la famille des Cupulifères.*” It is an interesting and instructive study of the meaning and application of the term species as employed by naturalists, its limits and those of its members, in time and area, their origin, future, and modifications. For such a study he suggests the term *epiontology*.

The second is entitled “*La Phytographie, ou l'art de décrire les végétaux considérés sous différents points de vue,*” published in 1880. Founded primarily on the principles so well laid down by Linnæus, this excellent work embodies the results of de Candolle's own long experience and those of his predecessors and contemporaries, on the methods that should be followed by biologists, whether botanists or zoologists, in describing organised beings. In this work the good effect of de Candolle's legal training is conspicuous, for the principles which he would see adopted, besides being unexceptionable, are laid down with judgment, precision, and moderation that leave nothing to be desired.

The third is his “*Lois de la Nomenclature Botanique,*” which appeared in 1867, and in which rules were given for selecting, amongst conflicting claims and opinions, the name a genus or species should bear, assuming that it had borne two or more. So impressed was de Candolle with the importance of this subject, that it was always

uppermost in his thoughts during forty years of his life, during which period he published twelve treatises on the subject. The result has been the general acceptance of the principles he laid down, and the adoption of the rules, except where expediency or exceptional conditions clearly require their modification or supersession.

Turning from A. de Candolle's taxonomic labours, it is on his 'Géographie Botanique Raisonnée,' published in 1858, that his most enduring claim, as a philosophical botanist, rests. The subject had early attracted his attention. He was drawn to it both by inclination and by his father's admirable 'Essai Élémentaire de Géographie Botanique' (published in 1820). An interesting chapter in his own monograph on *Campanulaceæ* (his earliest systematic work) is devoted to it; a more important one is embodied in his 'Introduction à l'Étude de la Botanique' (1835); and in 1848 he published ('Comptes Rendus') a suggestive essay on the northern limitation of plants, adopting as a leading principle the "Méthode des Sommes de Température," as laid down by Boussingault in his "Economie Rurale."

It is impossible in a notice like the present to give even a general review of the contents of a work covering such a wide range of interesting and important considerations as the 'Géographie Botanique Raisonnée,' and which enters into so many of these in extraordinary detail. The impressions left in the mind after a first perusal are of surprise at the astonishing number of the valuable observations collected and collated from apparently inexhaustible sources, the precision and methodical subdivision of the subject matter, and the scrupulous care with which the labours of every previous author and reasoner are treated. It may truly be said of the author of the 'Géographie Botanique,' as has been of Darwin's 'Origin of Species,' that he has utilised to the best purpose the waste and the rejected observations of scores of less sagacious reasoners. Throughout the work the search for general principles and laws is conspicuous. No methods known to him are left untried, the statistical above all others, and even when these all fail, the materials left for the analysis of future thinkers are so well knit together and so absolutely trustworthy that they have in numberless instances proved of great value. The most conspicuous instance of this is to be found in the exhaustive chapters devoted to the influences of heat and light on the development of individuals and of species, and on the distribution of the higher groups of plants. Though not always leading directly to a precise correlation of cause with effect in the desired direction, the value of these researches appears in another chapter, where it is shown by a reference to them that the limitation of species, whether on plains or mountains, is determined by the amount of heat above the freezing point of water, that is absorbed during the months

occupied in growth, and not by the means or extremes of annual temperature. Influenced, no doubt, by his early legal studies, there is throughout the 'Géographie Botanique' a disregard, almost amounting to a negation, of speculative and theoretical considerations; but, under this point of view, it must be remembered that the 'Origin of Species' had not as yet appeared; that Forbes' and Lyell's pregnant suggestions, as affecting the dispersion of species, were not generally accepted, and that the doctrine of the multiple origination of individuals of a species was entertained, if not formally adopted, by de Candolle as the more probable theory of creation; as also that genera were considered by him to be more natural (better limited) groups than species.

In 1882 appeared the 'Origine des Plantes Cultivées,' an expansion of Chapter IX of the 'Géographie,' but which, being published thirty years later, and containing a vast amount of additional matter, is really a new and independent work. It is prefaced by two chapters, one on the supposed origin of the art of cultivation in different countries, the other on the methods he employed in tracing the sources whence cultivated plants have been obtained. These methods are botanical, archæological, palæontological, historical, and linguistic, in the application of all of which the author has shown great learning and judgment, and the result is a work of extraordinary interest and value. It has already gone through three editions, and a fourth is urgently needed, because many tropical cultivations have still to be dealt with, and because some very important supplemental facts, especially as regards plants of American origin, have been published in an elaborate review of de Candolle's work by Dr. A. Gray and J. H. Trumbull, in the 'American Journal of Arts and Sciences' (April—August, 1883).

Another work, though more of a literary than of a purely scientific character, must not be omitted in a review of de Candolle's labours: it is his 'Histoire des Sciences et des Savants depuis deux Siècles, précédée et suivie d'autres Études sur des sujets scientifiques, en particulier sur l'Hérédité et la Sélection dans l'espèce humaine,' of which the first edition appeared in 1873, and a greatly enlarged one in 1885. It need not be said that the 'Origin of Species' suggested this fascinating work, and that the writings of Grove, Spencer, Galton, and Wallace have all been largely drawn upon in its execution. Both genius and originality are displayed in it, whether in respect of the problem it essays to solve or the views which it sets forth. With his undeviating preference for the statistical method, he enumerates by name all the scientific men who had attained the honour of Associates and Correspondents of the Academies of Science of Paris and Berlin, and of Foreign Fellowship of the Royal Society of London, between 1664 and 1882, with their nationalities and the branches of

science for which they were distinguished. After subjecting the lists to a severe scrutiny, he finds that Switzerland carries away the palm, in respect of the number in proportion to its population, of the recipients of these academical honours. England he considers to be the country most favourably conditioned for intellectual culture, especially due to the facility with which its language may be acquired for reading purposes. This led to an analysis of the chief European languages, with the result that, owing to its "comparatively simple declensions and conjugations, its facility for forming compound words, and its abundance of short declamatory expressions, English is likely to become the universal language of the future."

By editing the autobiography of his distinguished father, A. de Candolle has enriched the history and literature of science. The father was a man of genius and varied attainments, a lover of society, and an excellent talker, who cultivated the acquaintance of the most intellectual people in France and England during the first forty years of the present century, and his autobiography contains instructive anecdotes, often racy and never injurious, of not a few of the most eminent men of his time.

A. de Candolle's professional career as a botanist began in 1831, when he was appointed Honorary Professor of Botany in the Academy of Geneva, assistant to his father as Director of the Botanical Gardens, and conductor of the students' herborizations. In 1841, on his father's death, he succeeded him in the chair, which he held till 1850. In 1835 he published, as a class book, his 'Introduction à l'Étude de la Botanique,' an excellent work, conceived and executed in the spirit of his father's 'Organographie Végétale.' It was reprinted in Belgium, and translated into German and Russian.

A. de Candolle's labours were not confined to botany, for throughout the active period of his life he was engaged in civic duties. As early as 1834 he was elected a representative of the Council of Geneva, later a member of the Constituent Assembly, and lastly of the Grand Council from 1862—1866. In all movements for the improvement of the city and well-being of his fellow-citizens and countrymen, especially the financial and charitable, he was a zealous and judicious advocate, and he published many well reasoned papers on these and kindred subjects. He was the first to advocate the Referendum in financial affairs, and the use of postage stamps in his canton, and subsequently in the Confederation. He was a zealous supporter of the Société de Physique et d'Histoire Naturelle de Genève, of the Société Helvétique des Sciences Naturelles, of the Société des Arts, and the Société de Lecture, and a perennial contributor to the 'Archives des Sciences Physiques et Naturelles.' Of separate publications and articles in scientific and other journals, M. Micheli* enumerates 235,

*: 'Archives des Sciences Physiques et Naturelles,' Geneva, December, 1893.

of which seventy-eight are included in the Royal Society's 'Catalogue of Scientific Papers' up to 1883. These embrace an extraordinary variety of subjects, and it can truly be said that all are thoughtful and worthy of serious attention.

Personally Alphonse de Candolle was distinguished for courtesy and liberality in thought and deed. Ever helpful, no one applied to him in vain for aid. His vast stores of knowledge, his herbarium, his library, and even his roof were at the service of all who could make good use of them. The herbarium and library were left to his son Casimir, under the conditions that they be open to botanists, and that he conducts the publication of the '*Monographiæ Phanerogamarum*' (continuation of the *Prodromus*). He married in 1832, Mademoiselle Jeanne Victoire Kunkler, who pre-deceased him, and by whom he had two sons. His residence was Geneva during the summer, and Valon, a few miles distant, in the winter, where he died 4th April, 1893, in his eighty-seventh year. Amongst the numerous honours conferred upon him was that of Correspondent of the Institute of France, of which body he was afterwards elected one of the eight Foreign Associates in succession to Agassiz. He was a Foreign Fellow of the Royal and Linnean Societies of London, and of most European and American academies, a Doctor of Laws of Oxford and Cambridge, and the recipient of various medals and orders, including the gold medal of the Linnean Society, and last, but not least, the Prussian order of "Pour le Mérite."

J. D. H

PIERRE JOSEPH VAN BENEDEN was born at Malines on the 19th of December, 1809, and died at Louvain on the 8th of January, 1894. His long life is one record of indefatigable industry in the pursuit of his favourite science, but otherwise was singularly uneventful. He received a medical education, and almost immediately after taking his degree, was, in 1831, appointed curator of the Natural History Museum of the University of Louvain, and in 1836, Professor of Zoology and Comparative Anatomy in the Catholic University founded in the same town, after the suppression of the ancient State University. He continued steadily to discharge the duties of this office, combined with an uninterrupted course of scientific research, until within a few days of his death, which resulted from a somewhat sudden attack of bronchitis. He rarely quitted his home except for the purpose of visiting museums, or with some other scientific object in view.

The jubilee of his professoriate was celebrated with great honour, both at Louvain and at his native town, in 1886, seven years before the termination of his career.

His earliest scientific work was devoted to the anatomy and de-

velopment of the Mollusca, the first published memoir from his pen, which appeared in the "Annales des Science Naturelles," for 1835, being upon the genus *Dreissena*. Numerous other papers followed one another in rapid succession, chiefly in the "Mémoires" or "Bulletins" of the Belgian Academy, and his researches soon extended into other branches of zoology, but mainly the aquatic, and especially marine forms of invertebrates (as Hydrozoa, Bryozoa, Turbellaria, Ascidians, Archiannelides, Crustacea, Hydrachnida, and Pentastomida), which frequent residences at Ostend during his academic vacations gave him opportunities of observing. For this purpose he established at his own expense in 1843 a marine laboratory and aquarium, which was one of the first, if not quite the first, of these now familiar institutions. He also greatly advanced the knowledge of the development, transformations and life-histories of the parasitic worms, and their relations to their respective hosts, one of his principal memoirs on this subject obtaining in 1858 the "*grand prix des sciences physiques*" of the Institute of France. A summary of his researches into a branch of zoology which he made peculiarly his own, was published in a popular form, as one of the International Scientific Series, under the title of "*Les commensaux et les parasites dans le règne animal*," 1875. Of this, English and German translations were issued.

It is singular that throughout nearly the whole of his long and industrious scientific career he was engaged more or less in two quite independent and very distinct lines of work, the one which has been referred to above, and another by which to many he was almost exclusively known, and which in his later days became of such absorbing interest as to give him little leisure for any other. Very early in life he was attracted by the discoveries of fossil bones of whales made during the excavations carried on in the formation of the fortifications at Antwerp, and this led to a systematic study of this group of mammals, then, owing to the want of materials in museums, most imperfectly known. With an extraordinary pertinacity and zeal, which was continued to the end of his life, he gathered from all available sources everything that could be known of the Cetacea, both existing and extinct, and published the knowledge he acquired in innumerable short papers and memoirs, and in several great and handsomely illustrated works, of which one, the "*Ostéographie des Cétacés vivants et fossiles*," 1868-80 (written in conjunction with Paul Gervais), will long remain the standard work of reference on the subject. Others especially relate to the extinct species found in the neighbourhood of Antwerp, and are included in a series, which also contains a description of the fossil seals from the same locality, published in the "*Annales du Musée Royal d'Histoire Naturelle de Bruxelles*."

Although it was chiefly among the lower forms of animal life and the Cetacea that Van Beneden came before the world as an original observer, a glance at the long list of his published memoirs (more than two hundred in number) show that subjects from various other groups occasionally engaged his attention and his pen, and he was also the joint author, with Paul Gervais, of a general work, in two volumes, on Medical Zoology, published in 1859.

Any notice of Van Beneden would be incomplete without reference to his high character and remarkably courteous and agreeable manners. He was gentle, modest, kind and considerate to others, and much beloved by all who knew him intimately, as the writer of this notice had many opportunities of observing, both in his own family circle at Louvain and on many visits which he paid to England, during which he was always a most welcome guest. Though he remained to the end a devoted son of the Church in which he had been brought up, he always showed the widest toleration for the views of others. The meetings of the British Association had a special attraction for him, and, more than once, he brought original communications before them. His last visit to this country was on the occasion of the tercentenary celebration of the University of Edinburgh in 1884, when he was the recipient of the honorary degree of LL.D. He was elected a Foreign Member of the Royal Society in 1875, and was also on the list of foreign members of the Linnean, Geological, and Zoological Societies of London. He was President of the Royal Belgian Academy in 1881, and on the occasion of his jubilee in 1886, was nominated Grand Officer of the Order of Leopold. He has left a large family of daughters and one son, Edward, Professor of Zoology in the University of Liege, who has already acquired a reputation in science which bids fair to equal, if not surpass, that of his father.

W. H. F.

ROBERT YOUNG ARMSTRONG* was the youngest son of the Rev. William Armstrong, incumbent of Calry, co. Sligo, Ireland, by his wife, Cassandra Maria, daughter of John Young, of Castlereagh, Roscommon, nephew of Dr. Matthew Young, F.T.C.D., Bishop of Clonfert.

He was born at Calry Glebe the 19th September, 1839. His early education was conducted at the Clergy Sons' Institute, at Lucan, and, later, at the Academic Institute, Harcourt Street, Dublin. He entered Trinity College, Dublin, in 1856, and finally obtained a commission in the Royal Engineers on the 21st December, 1858.

After being engaged for a few years in the construction of Fort Burgoyne, at Dover, he was sent in 1863 to Canada, where he was

* I am indebted to the 'Royal Engineers Journal' for the details of Colonel Armstrong's career.

stationed first at Montreal, and afterwards at Hamilton, on Lake Ontario. Returning to England in 1868, he was appointed Assistant-Instructor in Signalling at Chatham. His appointment was changed in 1871 to that of Assistant-Instructor in Telegraphy. General electricity and submarine mining were included in his educational duties, which he carried out with energy and enthusiasm. He liked the work, and, without doubt, he was specially fitted for it. During the succeeding twelve years, under his hands and those of his colleagues, the application of electrical science to military engineering received extraordinary development. He became a Captain on the 3rd August, 1872, and four years later succeeded Colonel Malcolm, R.E., as Instructor in Telegraphy, an important post which he held for nearly seven years.

To properly appreciate Armstrong's work during these years, it must be remembered that electrical science was comparatively in a backward condition. The instruments in use in the military telegraph service were obsolete. The methods of exploding charges for demolitions and for land mines were crude in design and uncertain in action. The use of the arc light for purposes of coast defence had scarcely been thought of, although the general subject of defence had been for some years attracting attention, and the desirability of employing booms and submarine explosives for the protection of ports had been considered. As the result of an exhaustive mintue by Sir John Burgoyne, the Floating Obstruction Committee carried out a number of experiments, and finally decided to introduce the principle of submarine mining. The organisation of the first submarine mining company fell to the lot of Armstrong and his staff at Chatham. Powers of invention, energy, and zeal were requisite, and fortunately for the public service he possessed them all.

The records of the War Office Torpedo Committee, 1871-1876, and the Proceedings of the Royal Engineers Committee, show clearly the important nature of his work in connection with the carefully-conducted experiments that were necessary in order that the apparatus might be brought to a high state of efficiency. He introduced the system of testing submarine mines by means of relays.

In 1879 he, with others, carried out a series of experiments preparatory to the employment of the arc light for coast defence.

He became a Major on the 9th October, 1879, and in January, 1883, he was appointed Electrical Adviser to the Board of Trade. The introduction of electric lighting made it necessary to pass an Act of Parliament. He advised the Board on the difficult points that arose in connection with the efficiency of supply and the public safety.

He succeeded Colonel Malcolm as Inspector of Submarine Defences at the War Office in June, 1884, and continued also to advise the

Board of Trade. However, in 1888, by reason of the increased vitality exhibited by electric lighting companies, he found his duties becoming so onerous that he resigned his post at the Board of Trade, and devoted the whole of his attention to the War Office. He received the thanks of the Board for the valuable services he had rendered the department.

He gave most arduous work to the organisation, both in personnel and matériel, of the submarine defences. He served on many committees appointed to report upon special questions of defences. He represented the War Department at many electrical exhibitions at home and in foreign countries.

He was elected a Fellow of the Royal Society in 1891.

On the 1st July, 1890, he had been promoted to the rank of Colonel in the army; and on the 30th May, 1891, had been gazetted a civil C.B.

On the 1st July, 1891, he was appointed Royal Engineer member of the Ordnance Committee. His health, however, failed, and he retired on a pension on the 7th December, 1892. At first, the rest appeared to act beneficially, but early in 1894 he caught a chill, from which his delicate constitution never recovered. He gradually became weaker, and passed away on 1st November, 1894, at Prospect House, Omeath, Ireland.

He was buried at Mount Jerome Cemetery, Dublin.

Armstrong was a man of high personal character, of affectionate disposition and gentle manners, and the most pleasant of companions. He was greatly beloved in his own corps, in which he had numerous friends, and also by those with whom he was associated in the many important posts he held. By them he is deeply mourned.

P. A. M.

BISSET HAWKINS was born in London, in the year 1796, and was at the time of his death, on December 7, 1894, the oldest Fellow of our Society, having been elected on December 18, 1834, as well as by some fourteen years the oldest Fellow of the Royal College of Physicians.

Dr. Hawkins' place in the history of science and of medicine is as a student of public medicine, at a time when sanitary authorities and general register offices had not been devised. Returning to London, after his graduation at Oxford in 1825, he presently took an interest in medical statistics, a subject then in its infancy, and in a volume enlarging his Gulstonian Lectures, of 1828, he brought together what records of disease and death were obtainable about various communities, and found in them—to use his own words—proof of the empire of human art over disease. In 1831, when cholera was threatening St. Petersburg, he made a serviceable col-

lection of facts, so far as they could be learned, respecting the march of the disease from India through Russia, and was able to end his story by telling of a Board of Health established for England, with Sir Henry Hallford, President of the College of Physicians, at its head.

Dr. Hawkins' professional knowledge, combined with his regard for numerical accuracy, was recognised by his appointment successively to office as Factory Commissioner and Inspector of Prisons. He rendered useful service in these capacities, particularly in pleading for abridgment of extravagant hours of labour by women and children, and by preventing serious sanitary mistakes by the Government of the time in its dealings with prisoners. He afterwards became a Commissioner in Lunacy.

When, in 1836, provision was made for registering births and deaths throughout England, Dr. Hawkins was in a position—in the counsels of the College of Physicians and of the Government—to speak with authority in favour of a proposal to record the fatal disease in the death register; along with the mere facts of identity and of time and place. Of course it could not be long before the value of this record was felt; and the column—at first reserved experimentally for “causes of death”—has long been seen to be the most important of all the columns of the register for the purposes of the community.

Dr. Bisset Hawkins, in 1838, urging on England a greater interest than she then took in the affairs of Germany “and her allied countries,” had to coin a phrase to distinguish the wider idea of social life taken in Germany from the subjects which formed the political economy of England at that period. He would have Englishmen study the “state economy” of Germany, her natural history, her educational, medical, and other concerns, that were at the beginning of the century much better cared for in Germany than in his own country. He lived to see his distinction well nigh effaced; and we may credit him with having helped to the effacement.

He spent the later years of his life at his residence at Bournemouth, in Dorsetshire, a deputy-lieutenant of the county, the ideal of an English country gentleman and retired scholar.

G. B.

ALBERT WILLIAM BEETHAM was born in London, on August 20, 1802, being the eldest son of William Beetham, F.R.S., Deputy-Lieutenant for the county of Middlesex. He was elected a Fellow of the Linnean Society on February 6, 1827, and of the Royal Society on February 5, 1835. He was appointed Clerk of the Cheque and Adjutant of the Honourable Corps of Gentlemen-at-Arms on July 3, 1835. In November, 1836, he was called

to the Bar at Gray's Inn, and practised as a special pleader on the Western Circuit. He was appointed Recorder of Dartmouth in 1860, and at the time of his death was Deputy-Lieutenant for the Tower Hamlets, and Justice of the Peace for Middlesex and the Tower Hamlets. He married, in 1827, Caroline Jane, daughter of John Caplin, Master of the Leathersellers' Company, of the City of London, and died at West Cliff, Dawlish, Devonshire, on March 11, 1895.

M. F.